SUMMER PACKET

For students going into

GEOMETRY

(reviews content of ALGEBRA 1)

Name: ____________________________

If there isn’t enough space for all of your work, use a separate piece of paper and attach it to this packet. If you are required by your middle school to do the packet, you will submit it to your math teacher the first week of school.
Performance Expectation

A1.1.A

Select and justify functions and equations to model and solve problems

Items assessing A1.1.A will ask students to analyze the rate of change (slope) in a function using a graph or table to determine if the function is linear or exponential. Students select model for functions and describe appropriate domain restrictions. Functions are then used to solve problems and interpret solutions in the context of the original situation. These items assessing this PE will include multiple choice or completion questions.

Students need to know:

- How to connect table and graph to a function (linear or exponential)
- It is important for students to be able to create a table for both linear and exponential functions and then to use the table to graph the function (a graphing calculator is really helpful)
- The characteristics of an exponential and linear graph and table and how to explain verbally the differences between linear and exponential
- That the domain of functions should be written in \( x \leq \) or \( x \geq \) format

Sample Questions

1. Study the pattern shown in the table. What is the value of \( s \) when \( r \) equals 10?

<table>
<thead>
<tr>
<th>( r )</th>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>( s )</td>
<td>7</td>
<td>11</td>
<td>15</td>
<td>19</td>
<td>23</td>
<td></td>
</tr>
</tbody>
</table>

   \( s = \) ______

   Write an equation that you can use to predict any value of \( s \) given \( r \). ____________________________

2. Julie’s grandfather gives her a dollar one day. Each day after that, he gave her twice as many dollars as he had given her on the previous day. Let \( f(n) \) represent the number of dollars Julie’s grandfather gave her on day \( n \).

   a) Which function models this situation?

      A. \( f(n) = 2^{n-1} \)  \quad B. \( f(n) = 2n \)

      C. \( f(n) = 2^{n+1} \)  \quad D. \( f(n) = (n - 1)^2 \)

   b) How much will Julie get on the 12th day of doubling? _______
3. Mr. Madison gave his students this pattern of white tiles:

He asked his students to write an equation to represent the number of white tiles, \( t \), for any figure number, \( n \).

Which equation represents the number of white tiles in the pattern?

A. \( t = 4n + 8 \)  
B. \( t = 4n + 4 \)  
C. \( t = n + 4 \)  
D. \( t = n + 2 \)

4. A cup is 5.2 cm tall, including a 0.8 cm lip that sticks out when stacked. Cups are stacked inside one another.
   
a) Find a function \( H \) that represents the height of a stack of cups in terms of the number of cups in the stack.

_______________________

b) How many cups are in a stack that is 34 cm high?

A. 6 cups  
B. 16 cups  
C. 26 cups  
D. 37 cups

5. During the month of August, Jamie will be house-sitting for her wealthy neighbor, Mrs. Gates. Mrs. Gates offers Jamie two different salary plans:
   
- Plan 1: $100 per day for the 31 days in August.
- Plan 2: $1 for August 1, $2 for August 2, $4 for August 3 and so on, with the daily rate doubling each day.

a. Write functions that model the amount of money Michelle will earn each day on Plan 1 and Plan 2. Justify the function you wrote with a table a written explanation.

Plan 1____________________                        Plan 2______________________

b. State an appropriate domain for each of the models based on the context.

c. Which plan should Michelle choose to maximize her earnings? Justify your recommendation mathematically.
Performance Expectation

Solve problems represented by linear functions, equations and inequalities (A1.1.B) and systems of linear functions, equations and inequalities (A1.1.C)

Items assessing A1.1.B and A1.1.C will ask students to represent word problems as functions, equations and inequalities. Students must analyze situations, and represent them mathematically. Students solve problems and check reasonableness of solutions as related to the context of original problems. These items may be short answer or completion.

Students need to know:
- How to express a word problem as an equation, function or inequality
- How to solve the problem for $f(x)$ or any given variable
- When an answer is reasonable for the given context
- How to set equations equal to one another to solve systems
- That graphing inequalities is helpful when determining solutions

Sample Questions

1. A classroom holds 36 desks. There are 15 desks occupied in the classroom already. Which inequality can be solved to show all the number of students, $s$, that can still have a desk in the classroom? Complete the inequality below.

   \[15 + s \quad \underline{\_\_\_\_\_} \quad 36\]

2. XYZ charges of $3 plus $5.50 per game downloaded. The GameBank.com charges an annual fee of $15 plus $2.50 per game. For how many game downloads will the cost be the same at both web sites and what is that cost?

   Fill in the blank giving the correct number of games and the cost.

   \[\underline{\_\_\_\_\_\_}\quad \text{games and } \underline{\_\_\_\_\_\_}\cdot\]

3. Two Plumbing companies charge different rates for their service. Clyde’s plumbing company charges a $75 per visit fee that includes one hour of labor plus $45 per hour after the first hour. We-Unclog-It Plumbers charges $100 per visit fee that includes one hour of labor plus $40 per hour after the first hour. For how many hours of plumbing work would Clyde’s be less expensive than We-Unclog-It?
4. At Seattle’s Best Coffee an employee has one cup of 85% milk (the rest is chocolate) and another cup of 60% milk (the rest is chocolate). She wants to make one cup of 70% milk. How much of the 85% milk and 60% milk should she mix together to make the 70% milk?

5. Radio Shack makes $100 profit on every DVD player it sells and a $60 profit on every CD player it sells. The store manager wants to make a profit of at least $600 a day selling DVD players and CD players.

a. Write a linear inequality to determine the number of DVD players \( x \) and the number of CD players \( y \) that the owner needs to sell to meet his goal.

\[
\text{Profit} = 100x + 60y \\ \geq 600
\]

b. Graph the linear inequality.

\[ \text{Graph of the inequality} \]

c. List three possible combinations of DVD players and CD players that the owner could sell to meet his goal.
**Performance Expectation**

**A.1.1.E**

Solve problems that can be represented by exponential functions and equations

Items will include functions of the form $y = ab^x$ where $b$ may be less than 1. Students may need to approximate solutions for $x$, or they may need to give numerically exact answers. This PE will include multiple choice or completion questions.

**Students will need to know:**
- A strategy for how to determine the value of $x$ in the equation $y = ab^x$ by estimating with a graph or table and by finding substituting and finding exact value. *(this work can be done on a graphing calculator)*
- How to generate a table of values and graph for an exponential equation
  
  For ex: $y = 3(4)^x$
- How to give a real-life exponential situation, be able to find solutions for $x$ or $y$

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**Sample Questions**

1. E.coli bacteria reproduce by division. Every 30 minutes one E.coli cell divides into two cells. A new E.coli culture is started with 1 cell.
   a. Generate a table of values using time for $x$ and cells for $y$.

<table>
<thead>
<tr>
<th>$x$</th>
<th>$y$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   b. Find a function that models the number of E.coli cells at the end of each 30-minute interval. View both the graph and the table on the graphing calculator to verify your function.

   

   c. State an approximate domain for the model based on the context.

   

   d. How many E.coli bacteria will be present after the 10th 30-minute interval?

   

   e. After what 30-minute interval will you have at least 600 bacteria?
2. Graph the exponential function \( y = -4(2)^x \)

A. 

B. 

C. 

D. 

---

3. Estimate the solution to \( 3^x = 59,049 \)  
Explain how you know you are correct. 

\[ x = \underline{\text{}} \] 

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4. For the function \( f(x) = \left(\frac{1}{2}\right)^x \) determine the value of \( f(x) \) when \( x = 0 \). 

Verify your answer using a table or graph on your graphing calculator. Sketch the results.
**Performance Expectation**

**A1.2.A**

Compare and order real numbers with and without a number line

Items assessing this may include real numbers written in scientific notation expressed in fractions, decimals, exponents or roots. These items will be assessed using **multiple choice**.

**Students need to know:**

- All real numbers can be placed on a number line
- Be able to place real numbers on a number line
- Be able to compare by changing numbers to decimal or other form to allow for comparison

**Example:** Order from least to greatest 
-2, 3.2, π, \( \frac{5}{4} \), -1.17, \( \sqrt{11} \)

Changed to decimal
-2.00, 3.20, 3.14, 1.25, -1.17, 3.32

Order
1st, 5th, 4th, 3rd, 2nd, 6th

**Sample Questions**

1. Place the following numbers in order from least to greatest.

   \( \pi, \ \frac{10}{3}, \ -3.34, \ 3.\overline{2}, \ 0, \ -\sqrt{9} \)

   A. \(-\sqrt{9}, \ -3.34, \ 0, \ \pi, \ 3.\overline{2}, \ \frac{10}{3} \)
   
   B. \(-3.34, \ -\sqrt{9}, \ 0, \ 3.\overline{2}, \ \pi, \ \frac{10}{3} \)
   
   C. \(-3.34, \ -\sqrt{9}, \ 0, \ \frac{10}{3}, \ 3.\overline{2}, \ \pi \)
   
   D. **None of the Above**

2. Order the following numbers from least to greatest:

   \( 6.32 \times 10^{3}, \ 6.32 \times 10^{-2}, \ 8.32 \times 10^{-4}, \ 7.32 \times 10^{-3} \)

   A. \( 8.32 \times 10^{-4}, \ 7.32 \times 10^{-3}, \ 6.32 \times 10^{3}, \ 6.32 \times 10^{-2} \)
   
   B. \( 6.32 \times 10^{3}, \ 8.32 \times 10^{-4}, \ 7.32 \times 10^{-3}, \ 6.32 \times 10^{-2} \)
   
   C. \( 6.32 \times 10^{-2}, \ 6.32 \times 10^{3}, \ 7.32 \times 10^{-3}, \ 8.32 \times 10^{-4} \)
   
   D. \( 8.32 \times 10^{-4}, \ 7.32 \times 10^{-3}, \ 6.32 \times 10^{-2}, \ 6.32 \times 10^{3} \)
**Performance Expectation**

**A1.2.B**

Determine all possible values of variable that satisfy prescribed conditions, and evaluate algebraic expressions that involve variables

Items assessing this may include polynomial, fractions, decimals, radicals, absolute value and numbers with integer exponents. These items are **multiple choice** or **completion**.

**Students need to know:**
- How to evaluate expressions that involve variables
- How determine possible values for a variable in a prescribed condition

### Sample Questions

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. For what values of ( a ) is ( \frac{1}{a} ) an integer?</td>
<td>A. when ( a ) is an integer</td>
</tr>
<tr>
<td></td>
<td>B. when ( a ) is a positive number</td>
</tr>
<tr>
<td></td>
<td>C. when ( a ) is greater than 0 and less than 1</td>
</tr>
<tr>
<td></td>
<td>D. when ( a ) is greater than 0</td>
</tr>
<tr>
<td>2. For what values of ( a ) is (-a) always a positive?</td>
<td></td>
</tr>
<tr>
<td>3. Given ( n ) is an integer greater than 0 and ( a ) is a real number when is ( a^n ) always negative?</td>
<td>A. when ( a ) is negative</td>
</tr>
<tr>
<td></td>
<td>B. when ( n ) is odd</td>
</tr>
<tr>
<td></td>
<td>C. when ( a ) is negative and ( n ) is even</td>
</tr>
<tr>
<td></td>
<td>D. when ( a ) is negative and ( n ) is odd</td>
</tr>
<tr>
<td>4. For what values ( a ) is ( \sqrt{5} - a ) defined (a real number)?</td>
<td>A. ( a &lt; 5 )</td>
</tr>
<tr>
<td></td>
<td>B. ( a &gt; 5 )</td>
</tr>
<tr>
<td></td>
<td>C. only 0</td>
</tr>
<tr>
<td></td>
<td>D. <strong>None of the Above</strong></td>
</tr>
</tbody>
</table>
**Performance Expectation**

A1.2.C

Interpret and use integers, exponents and square and cube roots and apply the laws and properties of exponents to simplify and evaluate exponential expressions.

These items include real numbers written in scientific notation, expressed in fractions, decimals, exponents, roots, absolute value, radicals and numbers with integer exponents. These items are multiple choice or completion.

**Students need to know:**

- Basic properties of exponents

<table>
<thead>
<tr>
<th>Properties</th>
<th>Algebraic example</th>
<th>Numeric example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product of powers property</td>
<td>$a^m a^n = a^{m+n}$</td>
<td>$2^3 2^4 = 2^{3+4} = 2^7 = 128$</td>
</tr>
<tr>
<td>Power of power property</td>
<td>$(a^m)^n = a^{mn}$</td>
<td>$(2^3)^2 = (2^{3+2}) = 2^6 = 64$</td>
</tr>
<tr>
<td>Power of product property</td>
<td>$(ab)^n = a^n b^n$</td>
<td>$(3<em>4)^2 = 3^2 4^2 = 9</em>16 = 144$</td>
</tr>
<tr>
<td>Quotient of power property</td>
<td>$\frac{a^m}{a^n} = a^{m-n}$</td>
<td>$\frac{3^5}{3^2} = 3^{5-2} = 3^3 = 27$</td>
</tr>
<tr>
<td>Positive power of a quotient property</td>
<td>$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$</td>
<td>$\left(\frac{5}{4}\right)^2 = \frac{5^2}{4^2} = \frac{25}{16}$</td>
</tr>
<tr>
<td>Negative power of a quotient property</td>
<td>$\left(\frac{a}{b}\right)^{-n} = \frac{b^n}{a^n}$</td>
<td>$\left(\frac{5}{6}\right)^{-3} = \frac{6^3}{5^3} = \frac{216}{125}$</td>
</tr>
<tr>
<td>Zero property of exponents</td>
<td>$a^0 = 1$</td>
<td>$8^0 = 1$</td>
</tr>
</tbody>
</table>

- Basic properties of square and cubed roots

<table>
<thead>
<tr>
<th>Properties</th>
<th>Algebraic example</th>
<th>Numeric example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product property of square roots</td>
<td>$\sqrt{ab} = \sqrt{a} \sqrt{b}$ where a and b are nonnegative</td>
<td>$\sqrt{100} = \sqrt{4} \sqrt{25} = 2 \cdot 5 = 10$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$\sqrt{20} = \sqrt{4} \sqrt{5} = 2 \cdot \sqrt{5}$</td>
</tr>
<tr>
<td>Quotient property of square roots</td>
<td>$\frac{\sqrt{a}}{\sqrt{b}} = \frac{\sqrt{a}}{\sqrt{b}}$ where a is nonnegative and b is greater than 0</td>
<td>$\sqrt{36}/\sqrt{4} = \frac{\sqrt{6}}{2} = 3$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$\sqrt{5}/\sqrt{9} = \frac{\sqrt{5}}{\sqrt{3}}$</td>
</tr>
<tr>
<td>cube roots behave as square roots except you can take the cubed root of a negative</td>
<td>$\sqrt[3]{-8} = \sqrt[3]{-2 \cdot -2 \cdot -2} = -2$</td>
<td>$\sqrt[3]{24x^5} = \sqrt[3]{8 \cdot 3 \cdot x^3 \cdot x^2} = 2x\sqrt[3]{3 \cdot x^2}$</td>
</tr>
</tbody>
</table>
## Sample Questions

1. Simplify \( \frac{a^{-2}b^2c}{a^2b^{-3}c^2} = \) _____________  

2. Simplify \( \frac{20x^2y}{5xy^3} = \) _______________  

3. Simplify \( \sqrt[5]{18a^2b^3} \)  
   A. \( 3ab\sqrt{2b} \)  
   B. \( 3ab\sqrt[2]{ab^2} \)  
   C. \( 3ab\sqrt{6b} \)  
   D. \( 9ab\sqrt{2b} \)  

4. Simplify \( \sqrt{90}/49 \)  
   A. \( \frac{\sqrt{45}}{7} \)  
   B. \( \frac{\sqrt{10}}{7} \)  
   C. \( \frac{3\sqrt{10}}{7} \)  
   D. \( \frac{3\sqrt{10}}{7} \)  

5. Simplify \( \sqrt[3]{125x^7} = \) _______________
Performance Expectation

A1.3.A
Determine whether a relationship is a function
Identify the domain, range roots and independent and dependent variables

Linear, quadratic, exponential and defined piecewise (step functions and absolute value of an expression) functions will be explored. This PE will be tested with multiple choice and short answer.

Students need to know:

- A strategy to determine whether a relationship is a function
- Definition: a function is a relation that pairs each element of the domain with exactly one element of the range. *Helpful hint on page 238 in text. “A list of ordered pairs is a function if all x values are different.”*
- How to create a table given the function that helps define a domain and range
- The vertical line test is a good visual for students if they graph the data in most data tables
- That square root functions and absolute value functions need to be studied, graphed and domains and ranges identified
- That graphing (graphing calculator encouraged) is essential for students who need a visual
- How to describe restrictions on the domain of a function that are appropriate for the problem context
- Be able to create a table or graph function (graphing calculator helps to view graph and table) to determine the domain of the function if given $f(x) = \sqrt{x}$ or $f(x) = \sqrt{x-5}$ or $f(x) = \sqrt{2+x}$
- Independent and dependent variables in contextual problems and when referring to $x$ and $y$ coordinates in table and on a graph

Sample Questions

1. Give the domain, $D$, and range, $R$, for each relation.

   A. $\{(−5,7), (0,0), (2,8), (5,−20)\}$
   B. $\{(1,2), (2,4), (3,6), (4,8), (5,10)\}$

   \[
   \begin{array}{|c|c|c|c|c|}
   \hline
   x & 3 & 5 & 2 & 6 & 1 \\
   \hline
   y & 9 & 25 & 2 & 81 & 36 \\
   \hline
   \end{array}
   \]

   \[
   \begin{array}{|c|c|c|c|c|}
   \hline
   D: \hspace{1cm} & R: \hspace{1cm} & D: \hspace{1cm} & R: \hspace{1cm} & \\
   \hline
   \end{array}
   \]
2. Express each relation as either a table, a graph or a mapping diagram to determine whether or not the relation is a function. Choose a representation that makes sense to you.

A. \( \{( -2, 5), (-1, -1), (0, 4), (2, -2), (3, -4)\} \)  
B. \( \{(3, 1), \left(3, \frac{1}{3}\right), (3,3), (3, -3)\}\)

3. Determine which of the following graphs is a function. Explain how you know you are right.

A.  

B.  

4. A function \( f(n) = 85n \) is used to model how the distance in miles traveled by a train traveling 85 miles per hour in \( n \) hours. Identify the independent and dependent variable of this function. (Discuss restrictions on the domain and range of this function should be considered for the model to correctly reflect the situation. Use a table or graph to help you.)

The independent variable is _______________ The dependent variable is __________________

5. What is the domain of \( \sqrt{x - 2} \) ?

A. \( x \geq 0 \)  
B. \( x \leq 2 \)  
C. \( x \geq -2 \)  
D. \( x \geq 2 \)
6. What is the domain of \( f(x) = \sqrt{x + 6} \) ?

A. \( x \geq 0 \)
B. \( x \leq -6 \)
C. \( x \geq -6 \)
D. \( x \leq 6 \)

7. Which of the following equations, inequalities or graphs determine \( y \) as a function of \( x \)?

\[
\begin{align*}
y &= \begin{cases} 
  x + 4, & x \leq 1 \\
  x - 3, & x > 1 
\end{cases} \\
x^2 + y^2 &= 4 \\
x &= 3 \\
y &= |x| \\
y &= 5
\end{align*}
\]
**Performance Expectation**

**A1.3.B**

Represent functions and make connections between the symbolic expression, the graph, the table

Students should be *introduced* to and able to use graphing calculator to discuss the graphs of a variety of functions (parent functions) such as, $\sqrt{x}$, $x^3$, $\frac{1}{x}$ and $|x|$. Students should know that $f(x) = \frac{1}{x}$ represents an inverse variation and $f(x) = |x|$ represents an absolute value function. This PE will be tested in *multiple choice* and *short answer* questions.

**Students need to know:**
- How to describe the graph of the parent functions above (*You will need graphing calculators for these exercises*)
- How to infer properties of the related functions...graphically as well as symbolically
- How to translate among the various representations of functions
- How to explain which representation has advantages and limitations when representing functions
- Graphs of linear, exponential, quadratic (and cubic when necessary)

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**Sample Questions** (*need graph paper*)

1. Create a table and sketch a graph of each group of equations.

<table>
<thead>
<tr>
<th></th>
<th>Equation Groups</th>
<th>What do you notice?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group 1</strong></td>
<td>$y = \frac{1}{x}$, $y = \frac{5}{x}$, $y = \frac{-5}{x}$</td>
<td></td>
</tr>
<tr>
<td><strong>Group 2</strong></td>
<td>$y = \frac{1}{x} + 3$, $y = \frac{1}{x} - 3$</td>
<td></td>
</tr>
</tbody>
</table>

2. Create a table and sketch a graph of the following pairs of absolute value equations.

<table>
<thead>
<tr>
<th></th>
<th>Equation Pairs</th>
<th>What do you notice?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pair 1</strong></td>
<td>$y =</td>
<td>x</td>
</tr>
<tr>
<td><strong>Pair 2</strong></td>
<td>$y =</td>
<td>x + 2</td>
</tr>
<tr>
<td><strong>Pair 3</strong></td>
<td>$y =</td>
<td>x</td>
</tr>
</tbody>
</table>
3. Which function does the graph represent?

A. \( y = 4x^2 \)  
B. \( y = |4x| \)  
C. \( y = \sqrt{x} + 4 \)  
D. \( y = \frac{4}{x} \)

4. **Profit Made per I-Pad Sold**

<table>
<thead>
<tr>
<th>Number of I-Pads Sold</th>
<th>Profit Made</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$600</td>
</tr>
<tr>
<td>2</td>
<td>$500</td>
</tr>
<tr>
<td>3</td>
<td>$450</td>
</tr>
<tr>
<td>4</td>
<td>$400</td>
</tr>
<tr>
<td>5</td>
<td>$350</td>
</tr>
<tr>
<td>6</td>
<td>$300</td>
</tr>
<tr>
<td>7</td>
<td>$250</td>
</tr>
<tr>
<td>8</td>
<td>$200</td>
</tr>
<tr>
<td>9</td>
<td>$150</td>
</tr>
<tr>
<td>10</td>
<td>$100</td>
</tr>
</tbody>
</table>

Which equation best represents the total profit \( P \) that an employee makes for selling any number of I-pads \( n \)?

A. \( P = 75(n + 2) \)  
B. \( P = 150n + 75 \)  
C. \( P = 75n + 75 \)  
D. \( P = 150(n + 1) \)

5. Pizza Hut employees are aware that a Pizza Pirate has infiltrated Pizza Hut. They have decided to leave one pizza out for the pirate to see what he or she does with it. On the first day, the employees set out a full pizza. When they arrive back at work the next day, day two, there is half of the pizza left. They again leave the pizza out at night and when they return the next day, day three, there is a fourth of the pizza remaining. This process continues for a total of ten nights. On the 11th day, how much pizza is left?

Display your answer in a  

a) table  

b) graph  

c) equation.
6. Write and graph the inverse variation in which \( y = 6 \) when \( x = 2 \) by following the steps below.

a. Find the constant of variation.
   \[ k = \phantom{0} \]

b. Write the inverse variation equation.
   \[ y = \phantom{0} x \]

c. Make a table of values and graph.

<table>
<thead>
<tr>
<th>( x )</th>
<th>-6</th>
<th>-4</th>
<th>-2</th>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Performance Expectation

A1.3.C
Evaluating functions

Functions may be described and evaluated with symbolic expressions, tables, graphs or verbal descriptions. This PE will be tested in multiple choice and completion questions.

Students need to know:
- How to recognize function notation and be able to distinguish between evaluating \( x \) when given \( f(x) \) and evaluating \( f(x) \) when given \( x \)
- How to write a function given a verbal situation and solve for different values of \( x \) or \( f(x) \)
- How to evaluate linear, exponential, piece wise or inversely proportional functions

Sample Questions

1. Evaluate \( f(x) = \frac{4}{x} \) for \( x = 20 \).
   
   A. \( f(x) = \frac{1}{5} \)
   
   B. \( f(x) = 5 \)
   
   C. \( f(x) = 24 \)
   
   D. \( f(x) = 80 \)

2. \( f(x) = 4x - 8 \). For what value of \( x \) is \( f(x) = -16 \) ?

   \[ x = \boxed{6} \]

3. Give the value of \( f(x) \) when \( x \) is 4.

   \[ f(x) = \boxed{1} \]

4. A party planner charges a $200 fee plus $18 per person for a party. The cost is a function of the number of people is shown in the graph to the right.

   Write an equation that represents the cost of a party as a function of the number of people.

   \[ \boxed{c = 200 + 18p} \]

5. Find the cost of catering the party for 75 people.

   A. $275
   
   B. $1350
   
   C. $1550
   
   D. $2000

6. How many people can attend the party if the party planner is charging $600?

   A. 20 people
   
   B. 22 people
   
   C. 24 people
   
   D. 31 people
**Performance Expectation**

**A.1.4.A**
Solve linear equations and inequalities in one variable

This PE will ask students to solve equations and inequalities in one variable without any context. They will not be required to write the equation or inequality, just solve. Absolute value equations and inequalities will be included. This PE will be tested using **multiple choice** and **completion** items.

**Students need know:**
- **Equations** may have one, none, or infinite solutions
- Absolute value **equations** will have two solutions
- How to solve compound **inequalities**. (inequalities that are “and” or “or” statements)
- Absolute value **inequalities** will have two limits and need to be expressed as a compound inequality
- How to identify the solution to an inequality on a number line

---

**Sample Questions**

1. Solve the following equations. Determine if they have one, none, or infinite solutions.
   a. \(-2x + 4 = 5 - 3x\)  
      \[\text{_______________________}\]
   b. \(5z = \frac{1}{2}(10z + 5)\)  
      \[\text{_______________________}\]
   c. \(3(x - 2) + 2 = 5x - 7 - 2x\)  
      \[\text{_______________________}\]
   d. \(6x - 1 = 4x + 8 - 6x - 3\)  
      \[\text{_______________________}\]
   e. \(2(x - 3) + 4x = 15 + 2x\)  
      \[\text{_______________________}\]

2. Solve the equations.
   \(|x - 5| = 12\)  
   \(x = \underline{\phantom{0}}\)  
   \(|x| - 5 = 12\)  
   \(x = \underline{\phantom{0}}\)
3. Solve the following inequalities.
   a. $4(2x - 3) \leq 2(4x - 6)$
   b. $5x - 4 \geq 3x + 2$
   c. $-9x - 6 < -2(4.5x + 3)$
   d. $8x - 2 > 16x + 10$

4. Solve $7 - 2x \leq 14$ and graph on the number line. Choose from the answers below.
   A.
   ![Graph A]
   B.
   ![Graph B]
   C.
   ![Graph C]
   D.
   ![Graph D]

5. Solve the following compound inequality. $11 < 2x + 3 < 21$
   A. $7 < x < 12$
   B. $14 < x < 24$
   C. $4 < x < 12$
   D. $4 < x < 9$
6. Solve the following compound inequality. \(2x + 1 < 1 \text{ OR } x + 5 > 8\)

   A. \(x < 0 \text{ OR } x > 3\)  
   B. \(x > 0 \text{ OR } x < 3\)  
   C. \(x > 0 \text{ OR } x > 3\)  
   D. \(x < 0 \text{ OR } x < 3\)

7. Solve \(|x - 8| \geq 4\) and then choose the number line which best represents the solution.
**Performance Expectation**

**A.1.4.B**

Write and graph an equation for a line given the slope and the y-intercept, the slope and a point on the line, or two points on the line, and translate between forms of linear equations.

This PE may present a linear equation in standard form, point-slope form, or slope-intercept form. Answer choices will all be presented in the same form (standard, point-slope, or slope-intercept). Intercepts will be represented as ordered pairs, (x, y). All questions for this PE will be in **multiple choice** format.

**Students need to know:**

- The slope (m) and y-intercept (0, b) and slope-intercept form $y = mx + b$
- The slope (m) and a data point $(x, y)$ and Point-slope form $(y - y_1) = m(x - x_1)$
- To determine the equation of a line given two data points $(x_1, y_1)$ and $(x_2, y_2)$
- How to use information given to write an equation in Standard form: $Ax + By = C$
- How to convert from one form of a linear equation to another
- For example how to convert an equation in standard form $(Ax + By = C)$ to an equation written in slope intercept form ($y = mx + b$)

**Sample Questions**

1. Write the equation for a line with a y-intercept equal to (0, $-5$) and a slope equal to $\frac{2}{3}$.

   A. $y = 5x + \frac{2}{3}$  
   B. $y = \frac{2}{3}x - 5$  
   C. $y = 5x - \frac{2}{3}$  
   D. $y = -\frac{2}{3}x - 5$

2. Write the equation for a line with a slope of 2 that goes through the point (1, 1).

   A. $y - 1 = 2(x - 1)$  
   B. $y + 1 = 2(x + 1)$

   C. $y - 1 = 2(x + 1)$  
   D. $y - 1 = 1(x - 2)$

3. Write the equation for a line that goes through the points $(6, -2)$ and $(-3, 5)$ in point-slope form.

   A. $y + 3 = -\frac{7}{9}(x - 5)$  
   B. $y - 5 = \frac{7}{9}(x - 3)$

   C. $y + 3 = \frac{7}{9}(x - 5)$  
   D. $y - 5 = -\frac{7}{9}(x + 3)$
4. Write the equation for a line passing through points (−1, 2) and (4, −23).
A. \( y = -\frac{1}{5}x + \frac{12}{5} \)  B. \( y = 5x + 3 \)  C. \( y = -5x - 3 \)  D. \( y = 5x - 3 \)

5. Write an equation in slope intercept form for a line passing through (3, 7) and (7, 4).
A. \( y = -\frac{3}{4}x + \frac{37}{4} \)  B. \( y = \frac{3}{4}x + \frac{37}{4} \)  C. \( y = -\frac{4}{3}x + \frac{37}{4} \)  D. \( y = -\frac{3}{4}x + \frac{4}{37} \)

6. Write the equation \( 3x + 2y = 5 \) in slope intercept form.
A. \( 2y = -3x + 5 \)  B. \( y = -3x + 5 \)  C. \( y = -\frac{3}{2}x + \frac{5}{2} \)  D. \( y = \frac{3}{2}x + \frac{5}{2} \)

7. Write the equation \( y + 3 = -4(x - 7) \) in slope intercept form.
A. \( y = -4x + 25 \)  B. \( y = -4x - 31 \)  C. \( y = 4x - 31 \)  D. \( y = -4x + 28 \)

8. Write the equation \( y - 1 = \frac{2}{3}(x - 6) \) in standard form.
A. \( y = \frac{2}{3}x - 3 \)  B. \( 2x + 3y = 9 \)  C. \( -2x + y = -3 \)  D. \( 2x - 3y = 9 \)

9. Describe the graph of the equation \( y = 7x - 3 \).
A. gradual increasing line that passes through the point (0,7)
B. steep decreasing line that passes through the point (0, 3)
C. gradual decreasing line that passes through the point (0, −3)
D. steep increasing line that passes through the point (0, −3)

10. Describe the graph of the equation \( y - 7 = \frac{1}{2}(x - 2) \)
A. flat line neither increasing or decreasing that passes through the point (−2, −7)
B. gradual decreasing line that passes through the point (2, 7)
C. gradual increasing line that passes through the point (2, 7)
D. steep increasing line that passes through the point (2, 7)
**Performance Expectation**

**A.1.4.C**

Identify and interpret the slope and intercepts of a linear function, including equations for parallel and perpendicular lines

This PE will ask students to analyze and interpret graphs in the context of real life situations. Students will generate tables and graphs to match given situations and state the meaning of the slope and y intercept. This PE will be tested using multiple choice items.

**Students need to know:**

- Parallel lines have the same slope and different y intercepts
- Perpendicular lines have slopes that are negative reciprocals where $m_1 \times m_2 = -1$
- What occurs at the point of intersection in contextual problems
- How to interpret linear relationships using a graph, table and linear function

**Sample Questions**

1. Cathy and Laura need to travel to a soccer team meeting located on the far side of town. Laura leaves from her house and Catarina leaves from school. The graph below shows the relationship between time and distance from their school.

What can be said about the intersection of the graphs of Laura and Catarina.

![Graph showing distance from school vs. time with Laura and Catarina's paths]

A. Laura and Caterina are both still at school.
B. Laura and Catarina are the same distance away at school.
C. Catarina is farther away from school than Laura.
D. Laura is farther away from school than Catarina.
2. What can be said about the relationship between the rate at which Laura travels and the rate at which Catarina travels.

A. Laura and Catarina are traveling at the same rate.
B. Laura is traveling at a faster rate than Catarina.
C. Originally, Laura was traveling at a faster rate than Catarina.
D. Catarina is traveling at a faster rate than Laura.

3. A 1200 gallon tank contains 300 gallons of water. Water begins to run into the tank at a rate of 25 gallons per hour. Write a linear function for the situation above.

A. $f(g) = 300g + 25$
B. $f(g) = 300g$
C. $f(g) = 25g + 1200$
D. $f(g) = 25g + 300$

4. When will the tank be full?

A. 12 hours
B. 24 hours
C. 36 hours
D. 48 hours

5. Jackie has a savings account with $156.50 and plans on saving $45 a week. She understands that for any given week, the amount of money in her savings account can be calculated using the equation $S = 45w + 156.50$. Which graph best fits her equation?

A.
B.
C.
D.
Given that the figure above is a square, find the slope of the perpendicular sides AB and BC. Describe the relationship between the two slopes.

A. AB has a slope of \( \frac{8}{5} \) and BC has a slope of \( -\frac{5}{8} \), which are negative reciprocal slopes.

B. AB has a slope of \( \frac{8}{5} \) and BC has a slope \( \frac{5}{8} \) which are reciprocal slopes.

C. AB has a slope of \( \frac{8}{5} \) and BC has a slope \( \frac{8}{5} \) which are the same slope.

D. AB has a slope of \( \frac{8}{5} \) and BC has a slope \( -\frac{8}{5} \) which are opposite slopes.
Performance Expectation

A.1.4.D
Write and solve systems of two linear equations and inequalities in two variables

This PE does not expect students to write a system of linear equations or inequalities, just solve. Items assessing this PE will be **multiple choice** or **completion**. Items assessing A1.4.D may include a blank grid for the student to use for work. This grid (if used for work) will not be assessed, rather only the multiple choice answer or completion answer will be. The problems will not be given in context.

Students need to know:
- How to solve systems of linear equations and inequalities using a variety of methods
  - graphically
  - substitution
  - elimination
- That the **solution to a system of linear equations is the intersection point** of the two lines
- That the **solution to a system of linear inequalities is the region of the coordinate grid** when the lines are graphed on the same grid
- How to solve for one or both variables in the solution to the system. For example they may be asked to solve for the variable \( x \), \( y \), or both \( x \) and \( y \)

Sample Questions

1. Solve the system of linear equations.
   \[-2x + y = 2\]
   \[x + y = -1\]
   
   A. \((2,1)\)  
   B. \((0,-1)\)  
   C. \((1,-2)\)  
   D. \((-1,0)\)

2. Solve the system of linear equations.
   \[3x + 6y = 0\]
   \[7x + 4y = 20\]
   
   A. \((-2, 4)\)  
   B. \((4, 2)\)  
   C. \((4, -2)\)  
   D. \((2, 4)\)
3. Solve the system of linear equations.

\[ y = -\frac{1}{3}x - 2 \]

\[ y = \frac{4}{3}x + 3 \]

4. Which ordered pair is the solution to the system?

\[ 2x - y = -2 \]

\[ \frac{1}{3}y = x \]

A. (0,2)  
B. (2,6)  
C. (1,3)  
D. (3,8)
5. For the system of equations:

\[ x = 2y + 6 \]
\[ y = -3x + 4 \]

The value of \( x \) is equal to _______________.

6. Graph the two linear equations on the same coordinate plane to find the solution.

\[ x = -y + 3 \]
\[ -2x - 1 = y \]

Solution:________________

7. Graph the system

\[ \begin{align*}
  y &< -2x + 3 \\
  y &\leq 6x + 6
\end{align*} \]

a. Is \((0, 0)\) a solution of the system you graphed? __________

b. Is \((-4, 5)\) a solution of the system you graphed? __________
8. Graph the system of linear inequalities:

\[
\begin{align*}
    y & \leq -2x + 3 \\
    y & > -2x - 3
\end{align*}
\]
Performance Expectation

A.1.4.E

Describe how changes in the parameters functions (linear and absolute value of a linear) affect their graphs and the relationships they represent

This PE will ask students to analyze functions and interpret their graphs to state how changes in the parameter affect both the function and its related graph. This PE will be tested using multiple choice and short answer items.

Students need to know:

- Linear function notation \( f(x) = x \) can be expressed in slope-intercept form \( y = mx + b \) where \( m \) and \( b \) are parameters that change the graph of the original function
- That \( f(x) = kx \) represents a direct variation which is a proportional relationship
- How to recognize \( f(x) = kx \) graphically and as an equation
- How to use a graphing calculator to note how changes in parameters affect the graph of linear and absolute value functions

Sample Questions

1. Below is the graph of the function \( f(x) = |x| \).

Which of the graphs below best represents the function \( f(x) = -\frac{1}{2}|x| \).

A. 

B.
2. Which graph below is the correct transformation of \( f(x) = x \) to \( g(x) = 3x? \)
3. A student filmmaker has a budget of $5000 to make a film. He begins filming which costs $75 an hour. Find a function that represents this situation.

A. \( C = 5000 + 75h \)  
B. \( C = 5000h + 75 \)  
C. \( C = 5000h - 75 \)  
D. \( C = 5000 - 75h \)

4. If the cost to film increases to $100 an hour, how will this increase affect the function above?

5. How will the graph change if the filming costs increases from $75 an hour to $100 an hour?

6. Determine the x and y intercepts for the graph and define the meaning of each if the filming costs are $100 an hour.

Y intercept: _________________________________________________

X intercept: _________________________________________________

7. At the last minute, the student filmmaker discovers he must pay $1500 to rent the building and $100 an hour for filming. At this rate, how many hours will the student be able to spend filming before he runs out of money?

A) 3.5 hours  
B) 30 hours  
C) 35 hours  
D) 40 hours
Performance Expectation

A1.6.A

Use and evaluate the accuracy of summary statistics to describe and compare data sets

Items assessing A1.6.A may present data sets numerically or graphically and will expect students to compute and/or evaluate the appropriateness of different measures of center and variability to describe data sets. These questions will be multiple choice and/or short answer.

Students need to know:

- That the mode is the value or values that occur most often
- A data set may have one mode or more than one mode
- If no value occurs more often than another, we say the data set has no mode
- The range of a set of data is the difference between the least and greatest values in the set
- The range describes the spread of the data
- A value that is very different from the other values in a data set is called an outlier
- In the data set below one value is much greater than the other values

- Summary statistics can be shown in different ways; typically they are shown as lists or graphically as a box and whisker plot.

1. Josh scored 75, 75, 81, 84, and 85 on five tests. Use the mean, median, and mode of his scores to answer each question.

   mean = 80    median = 81    mode = 75

2. 3, 4, 5, 5, 6, 6, 7, 8, 9, 10, 10, 11, 11, 12, 12, 13, 15, 20

   Minimum: 3   Q1: 6   Q2: 10   Q3: 12   Maximum: 20

   First quartile: 6    Third quartile: 12
Sample Questions

1. The amounts of Cathy’s last six clothing purchases were $109, $72, $99, $15, $99, and $89.
   For each question, choose the mean, median, or mode, and give its value.
   a. Which value describes the average of Cathy’s purchases?

   b. Which value would Cathy tell her parents to convince them that she is not spending too much money on clothes? Explain.

   c. Which value would Cathy tell her parents to convince them that she needs an increase in her allowance? Explain.

2. The finishing times of two runners (Jamal and Tim) for several one-mile races, in minutes, are shown in the box-and-whisker plots.

   a. Who has the fastest time? 
   b. Who has the slowest time?

   c. Make a convincing argument that Jamal is the faster runner.

3. The number of traffic citations given daily by two police departments over a two-week period is shown in the box-and-whisker plots. Choose the letter of the best answer.

   a. What is the best estimate of the difference in the greatest number of citations given by each department in one day?
   A. 10 B. 20 C. 30 D. 35

   b. What is the difference in the median number of citations between the two departments?
   A. about 8 B. about 15 C. about 22 D. about 40

   c. Which statement is NOT true?
      A. The East department gave the greatest number of citations in one day.
      B. The East department gave the least number of citations in one day.
      C. The East department has a greater IQR than the West department.
      D. The East department has the greater median number of citations in one day.
## Performance Expectation

**A1.6.B**

Make valid inferences and draw conclusions based on data

Items assessing A1.6.B may expect students to determine whether arguments based on data confuse association with causation. Students will need to evaluate the reasonableness of and make judgments about statistical claims, reports, studies, and conclusions. These questions will be multiple choice and/or short answer.

### Students need to know:

- Causation vs. Association
- Statistics can be misleading because of the way the data is collected or the way the results are reported
- A random sample is a good way to collect unbiased data. In a random sample, all members of the group being surveyed have an equal chance of being selected
- Common misleading statistics:
  
  I. graph intervals  
  II. scales can exaggerate differences  
  III. circle graphs not totaling 100%  
  IV. circle graphs not being area proportional  
  V. sample sizes that are too small.

### Sample Questions

1. The circle graph below shows how a school distributed money.

![School Budget](image)

   a. How is the graph misleading?

   b. What might someone believe because of this graph?

   c. Who might want to use this data?

2. Mr. Shapiro found that the amount of time his students spent doing mathematics homework is positively correlated with test grades in his class. He concluded that doing homework makes students' test scores higher. Is this conclusion justified? Give evidence to support your answer.

3. Joe found that cities with lots of police officers have higher rates of crime. He concluded that as the number of police officers increase, the amount of crimes committed increase as well. Is his conclusion justified? Give evidence to support your answer.

4. When boat rentals increase, ice cream sales also increase. Therefore, when people rent boats they eat a lot of ice cream. To what extent is this conclusion accurate? Give evidence to support your answer.
Performance Expectation

A1.6.C
Describe how linear transformations affect the center and spread of univariate data

These items will be assessed using multiple choice questions.

Students need to know:
- Univariate data: Data of a single variable e.g. test scores or ages of students in a school
- Linear transformations: adding, subtracting, multiplying or dividing by a constant value
  I. An example of this would be a teacher adding 5 points to every student’s test grade

The following chart shows an example of how applying a linear transformation to univariate data would affect the data

<table>
<thead>
<tr>
<th></th>
<th>Adding 10</th>
<th>Subtracting 10</th>
<th>Multiplying by 10</th>
<th>Dividing by 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>+ 10</td>
<td>− 10</td>
<td>× 10</td>
<td>÷ 10</td>
</tr>
<tr>
<td>Median</td>
<td>+ 10</td>
<td>− 10</td>
<td>× 10</td>
<td>÷ 10</td>
</tr>
<tr>
<td>Mode</td>
<td>+ 10</td>
<td>− 10</td>
<td>× 10</td>
<td>÷ 10</td>
</tr>
<tr>
<td>Range</td>
<td>No Change</td>
<td>No Change</td>
<td>× 10</td>
<td>÷ 10</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>No Change</td>
<td>No Change</td>
<td>× 10</td>
<td>÷ 10</td>
</tr>
</tbody>
</table>

Sample Questions

1. *A teacher gives a test and the students earn an average (mean) score of 75%. Describe how each of the following is affected if the teacher curves the test by increasing every score by 10%.
   *this question is free response, items assessing A1.6.C are multiple choice

<table>
<thead>
<tr>
<th>Mean</th>
<th>Median</th>
<th>Range</th>
<th>Mode</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. A company has a particularly profitable year; the company decides to double every employee’s salary. Which of the following will NOT change?

   A. Standard Deviation
   B. Mean
   C. Median
   D. Range

3. After a sharp decrease in dairy costs an ice cream company decides to reduce all of their prices by $0.25. What is the affect on the mean and standard deviation of the prices of all the company’s products?

   A. The both stay the same
   B. The both decrease by $0.25
   C. Only the mean decreases by $0.25
   D. Only the standard deviation decreases by $0.25
Performance Expectation

A1.6.D

Find the equation of a linear function that best fits bivariate data that are linearly related, interpret the slope and y-intercept of the line, and use the equation to make predictions.

Items assessing A1.6.D may expect students to make predictions involving interpolating and extrapolating from the original data set. Students will be asked to draw a line that fits the data rather than a line of best fit. These questions will be multiple choice and/or short answer.

Students need to know:

- How to pick two points that represent the data well
- How to use the slope formula to write the slope and determine the equation
- That slope represents change in y values over change in x values
- That the Y intercept is the value of y when x is zero

Sample Questions

This is the published gas mileage of a car. Graph this data on a coordinate plane and draw a line that fits this data.

<table>
<thead>
<tr>
<th>Speed (s)</th>
<th>Miles per Gallon (M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>18</td>
</tr>
<tr>
<td>35</td>
<td>20</td>
</tr>
<tr>
<td>40</td>
<td>23</td>
</tr>
<tr>
<td>45</td>
<td>25</td>
</tr>
<tr>
<td>50</td>
<td>28</td>
</tr>
<tr>
<td>55</td>
<td>30</td>
</tr>
</tbody>
</table>

Answer the following questions:

1. Write a linear equation of the data in the table above._____________________________________

2. What is the meaning of the y-intercept given this data? _________________________________

3. What is the meaning of the slope given this data? _________________________________

4. Using your equation, what MPG will the car get at 100mph? _________________________________

   Do you think this is likely? _________________________________

5. How well does a linear function model this data? _________________________________
Performance Expectation

A1.6.E

Describe the correlation of data in scatter plots in terms of strong or weak and positive or negative.

The questions assessing this PE will be multiple choice.

Students need to know:
- A scatter plot is helpful in understanding the form, direction, and strength of the relationship between two variables.
- Correlation is the strength and direction of the relationship between the two variables.

Sample Questions

* these questions have 5 options, multiple choice questions will be limited to 4 options on the EOC.

Select the description that best matches data shown in the following graphs.

1. A. strong positive  
   B. strong negative  
   C. weak positive  
   D. weak negative  
   E. no correlation

2. A. strong positive  
   B. strong negative  
   C. weak positive  
   D. weak negative  
   E. no correlation

3. A. strong positive  
   B. strong negative  
   C. weak positive  
   D. weak negative  
   E. no correlation
Performance Expectation

A1.7.A

Sketch the graph of exponential functions $y = a \cdot b^x$ and describe effects in changes of parameters $a$ and $b$

Students should be able to sketch the graph for an exponential function of the form $y = a \cdot b^x$ where $x$ is an integer. The need to describe the effects that changes in the parameters $a$ and $b$ have on the graph, and answer questions that arise in situations modeled by exponential functions. Items assessing this may include comparisons between exponential functions. These items are multiple choice and short answer.

Students need to know:

- How to graph a function in the form of $y = a \cdot b^x$ and be able to describe changes to the graph as a result of changes to $a$ and $b$. (*on graphing calculator)
- $a > 1$ will stretch the graph vertically (become steeper)
- $a < 0$ will flip the graph over the x axis
- $0 < a < 1$ will compress the graph vertically (become shallower)
- $b > 1$ is a growth function
- $0 < b < 1$ is a decay function

Sample Questions

1. Which graph represents $A) y = 3 \cdot 2^x \quad B) 3\left(\frac{1}{2}\right)^x$

   ![Graphs]
2. A realator estimates that a certain new house worth $500,000 will gain value at a rate of 6% a year. Make a table that shows the worth of the house for years 1, 2, 3 and 4. What is the real-world meaning of year? Choose the correct representation from the choices below.

<table>
<thead>
<tr>
<th>Year</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value ($)</td>
<td>500,000</td>
<td>530,000</td>
<td>560,000</td>
<td>590,000</td>
<td>620,000</td>
</tr>
</tbody>
</table>

Year 0 is the year when the house is new. The model that best represents the data in the table is exponential because the value increases at an exponential rate. A function for the data is \( y = 500,000(1.06)^x \).

B.

<table>
<thead>
<tr>
<th>Year</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value ($)</td>
<td>500,000</td>
<td>530,000</td>
<td>561,800</td>
<td>595,000</td>
<td>631,238.48</td>
</tr>
</tbody>
</table>

Year 0 is the year when the house is new. The model that best represents the data in the table is exponential because the value increases at an exponential rate. A function for the data is \( y = 500,000(1.06)^x \).

C.

<table>
<thead>
<tr>
<th>Year</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value ($)</td>
<td>500,000</td>
<td>470,000</td>
<td>441,000</td>
<td>415,292</td>
<td>390,374.48</td>
</tr>
</tbody>
</table>

Year 0 is the year when the house is new. The model that best represents the data in the table is exponential because the value increases at an exponential rate. A function for the data is \( y = 500,000(1.06)^x \).

D.

<table>
<thead>
<tr>
<th>Year</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value ($)</td>
<td>500,000</td>
<td>530,000</td>
<td>560,000</td>
<td>590,000</td>
<td>620,000</td>
</tr>
</tbody>
</table>

Year 0 is the year when the house is new. The model that best represents the data in the table is exponential because the value increases at an exponential rate. A function for the data is \( y = 500,000(1.06)^x \).
3. The exponential function $f(x) = 2^x$ is reflected over the x axis what will be the transformed function?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A. $g(x) = -0.5^x$</td>
<td>C. $g(x) = -2^x$</td>
</tr>
<tr>
<td>B. $g(x) = (-2)^x$</td>
<td>D. $g(x) = (0.5^x)$</td>
</tr>
</tbody>
</table>

4. A computer is worth $4000$ when it is new. After each year it is worth half what it was the previous year. What will its worth be after 4 years? Round your answer to the nearest dollar.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A. $1000$</td>
<td>C. $125$</td>
</tr>
<tr>
<td>B. $250$</td>
<td>D. $500$</td>
</tr>
</tbody>
</table>
### Performance Expectation

**A1.7.B**

Find and approximate solutions to exponential equations

Items assessing this will include equations of the form $y = ab^x$ where $b$ is greater than 1 and may expect students to approximate solutions and, when possible give exact numerical solutions. These items are **multiple choice**.

**Students need to know:**
- How to graph an exponential function and read values from the graph
- (If using a chart) How be able to approximate an intermediate value

### Sample Questions

1. Given the graph of $2^{(\frac{1}{3})^x}$ what is the approximate value $f(-1)$.

<table>
<thead>
<tr>
<th></th>
<th>A. 1</th>
<th>B. 6</th>
<th>C. -1</th>
<th>D. 18</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2. Give the table of values for $3^x$ estimated the value of $3^{3.5}$.

<table>
<thead>
<tr>
<th>$x$</th>
<th>$y$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>27</td>
</tr>
<tr>
<td>4</td>
<td>81</td>
</tr>
</tbody>
</table>

A. 27.5  
B. 50  
C. 10.5  
D. 75

3. Using a graphing calculator estimate the solution to $2^x = 20$  

A. $x \approx 10$  
B. $x \approx 78$  
C. $x \approx 4.3$  
D. $x \approx 5.3$
**Performance Expectation**

**A1.7.C**

Find and approximate solutions to exponential equations

Items assessing this will include the expression of both arithmetic and geometric sequences in explicit and recursive forms, translating between the two forms, explaining how rate of change is represented in each form, and using the forms to find specific terms in the sequence. These items are multiple choice and completion.

### Students need to know:

<table>
<thead>
<tr>
<th>Arithmetic sequences – terms in the sequence differ by a common difference.</th>
<th>Geometric sequences – the ratio of successive terms is the same number</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 5 10 15 20</td>
<td>3 9 27 81 243</td>
</tr>
<tr>
<td>Difference of 5</td>
<td>Ratio of 3</td>
</tr>
</tbody>
</table>

### Arithmetic sequences

Explicit form used to determine any number in the sequence

\[ a_n = a_1 + (n - 1)d \]

- \(a_1\) = the first term
- \(d\) = the difference between terms
- \(n\) = number in the sequence you want
- \(a_n\) = the \(n\)th term in the sequence

Recursive form used to determine next number in the sequence

\[ a_{n+1} = a_n + d \]

- \(a_{n+1}\) = the next term
- \(a_n\) = the known term
- \(d\) = the difference between terms

### Geometric sequences

Explicit form used to determine any number in the sequence

\[ a_n = a_1 (r)^{n-1} \]

- \(a_1\) = the first term
- \(r\) = the common ratio
- \(n\) = number in the sequence you want
- \(a_n\) = the \(n\)th term in the sequence

Recursive form used to determine next number in the sequence

\[ a_{n+1} = a_n \cdot r \]

- \(a_{n+1}\) = the next term
- \(a_n\) = the known term
- \(r\) = the common ratio

---

### Sample Questions

1. Find the 20\(^{th}\) term in the arithmetic sequence -4, 1, 6, 11, 16,……

   | A. 95 | B. 96 | C. 72 | D. 91 |

2. Give the formula you used to do the above problem.
3. Find the next 3 term in the geometric sequence -36, 6, -1, $\frac{1}{6}$, ....

| A. -1, 6, -36 | B. $\frac{1}{36}, -\frac{1}{216}, -\frac{1}{1296}$ |
| C. $\frac{1}{1296}, \frac{1}{216}, -\frac{1}{36}$ | D. $-\frac{1}{36}, \frac{1}{216}, -\frac{1}{1296}$ |

4. Give the formula you used to do the above problem.

5. The first term in geometric sequence is 512, and the common ratio is 0.5. What is the 8th term of the sequence?

| A. 22.63 | B. 2 |
| C. 4 | D. 8 |

6. Give the formula you used to do the above problem.

7. The function $f(x) = 5000(0.972)^x$, where $x$ is the time in years, models a declining lemming population. How many lemmings will there be in 6 years?

| A. about 4860 lemmings | B. about 4028 lemmings |
| C. about 29160 lemmings | D. about 4216 lemmings |
**Performance Expectation**

**A1.7.D**

Solve an equation involving several variables by expressing one variable in terms of the others

Items assessing this will include a maximum of four variables in an equation. These items are **multiple choice**.

Students need to know:

- How to isolate a particular variable by using reverse order of operation

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### Sample Questions

1. Solve $a=lw$ for $l$

   - A. $\frac{w}{a} = l$
   - B. $\frac{a}{w} = l$
   - C. $awl = l$
   - D. $aw = l$

2. Solve $p=2L + 2w$ for $w$

   - A. $p+2L = 2w$
   - B. $\frac{p-2L}{2} = w$
   - C. $2(p-2L) = w$
   - D. $p - 2L - 2 = w$

3. Solve $A=\pi r^2$ for $r$.

   - A. $\frac{A}{\pi r} = r$
   - B. $\frac{A}{2\pi} = r$
   - C. $a\pi = r$
   - D. $\sqrt{\frac{A}{\pi}} = r$